



Institute of Electrical and Electronic Engineers  
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## Fort Wayne Section Technical Meeting

Social Hour & Pizza: 6:00PM-6:30PM  
Tuesday, February 28, 2017, 6:30PM-7:30PM

### Meeting Location

IPFW Engineering & Technology Building – Room ET 311  
Please go to Ft Wayne Section web site to register for the event:

[https://purdue.qualtrics.com/SE/?SID=SV\\_0lkanjGtPGLURG5](https://purdue.qualtrics.com/SE/?SID=SV_0lkanjGtPGLURG5)

By February 26 – Seating is limited



**Pizza  
Provided**

# DEVELOPMENT OF BRAIN-MACHINE INTERFACE TECHNOLOGY TO CONTROL ROBOTIC DEVICE IN REAL TIME

## Speaker

Jaydip Desai, PhD  
Director of Human-Machine Interface Lab  
Department of Biomedical Engineering  
Indiana Institute of Technology.

## Abstract

Brain-Machine Interface (BMI) technology is currently being investigated to restore physiological functions for motor disabled person using invasive/noninvasive approach. Our Human-Machine Interface (HMI) lab focuses on noninvasive method to acquire EEG signals from human brain, develop EEG signal processing techniques and extract features to control various robotics devices using motor imaginary signals from human brain. We have developed a real time BMI technique to control two robotic hands and an automobile robot when right/left hand imagination/movement happens. Project used Emotiv, 14 channel wireless EEG, and Cognionics, 32-channel high-density dry electrodes wireless EEG system, to acquire raw EEG data at 128 and 500 Hz sampling frequency respectively. Ten human subjects were participated in neuroscience

study for robotic hand control project and four human subjects were participated in a research study to evaluate the Cognionics headset and generate frequency spectrum of C3 and C4 electrodes during hand movements. Matlab script was developed to decompose Alpha (8-13 Hz) and Beta (13-30 Hz) waves from each electrode's EEG signal. Power spectrum density was calculated and three features (right, left and relax) were extracted from the designed script. IRobot Roomba, mobile robot, used with bluetooth access module and wireless camera to control the movement and provide visual feedback to the user. Noninvasive BMI system performs 90 degrees clockwise/anticlockwise movement of the robot during right/left hand movement/imagination with a constant forward velocity during relaxation. Project will use neural network and support vector machine algorithms to extract more features, which will be implemented into power wheelchair controller unit for the motor disabled person.

### **Bio of the Speaker**

Dr. Jaydip Desai is an assistant professor of biomedical engineering and director of Human-Machine Interface lab at Indiana Tech. He received doctoral (2014) and master's (2010) degrees in biomedical engineering with graduate certification in robotics & control (2013) from mechanical engineering at Stevens Institute of Technology, Hoboken, NJ, USA. Dr. Desai has received bachelor's (2008) degree in biomedical & instrumentation engineering from U. V. Patel College of Engineering, Ganpat University, Kherva, Gujarat, India.

Dr. Desai has gained diverse engineering background in the field of prosthetics, medical robotics, biosimulation and bioinstrumentation. He worked closely with Dr. Arthur Ritter to develop Warren Wells '42 Biorobotics lab at Stevens. Dr. Desai joined Indiana Tech as a tenure-track assistant professor of biomedical engineering in Aug 2013. He started Human-Machine Interface (HMI) lab to design & develop biorobotics algorithms to control various robotic devices using human physiological signals from human body. His lab supports senior design projects and industry-institute collaboration.

Dr. Desai reviewed abstracts for neural engineering, biomedical robotics, biomechanics and undergraduate research design tracks for the 2014, 15 and 16 BMES annual meetings. He also reviewed journal papers for WASET and Journal of Medical and Biological Engineering (JBME). He was selected to co-chair neural engineering and biomedical robotics sessions in 2014 and injury biomechanics session in 2016 Biomedical Engineering Society (BMES) annual meetings. Dr. Desai was a session chair for the 17th International Conference on Medical and Biological Engineering (ICMBE) in 2015. Recently, Dr. Desai elevated to IEEE Senior Membership based on his significant performance in the field. He also served as IEEE Young Professional and Chapter/Affinity chair for the IEEE Fort

Wayne Section. Dr. Desai also received an honorary faculty membership in Alpha Eta Mu Beta (AEMB), national biomedical engineering honor society, for his work to start and support Indiana Tech AEMB Student chapter. He is a professional member of BMES, AEMB, IEEE, ASR, WASET and IAENG.

Dr. Desai has published papers in journals and conference proceedings such as International Journal of Medical, Health, Biomedical and Pharmaceuticals Engineering, Scholars Journal of Engineering and Technology, and IEEE Conference Proceedings. He has given oral presentations in international/national level conferences: Northeast Bioengineering Conference, Clinical Robotic Surgery Association and International Conference on Medical and Biological Engineering. Dr. Desai and his lab students presented technical posters in 2010, 2013 and 2016 Annual Biomedical Engineering Society Meeting, 2015 IEEE-CIS Metro Area Workshop conference, 2016 IEEE-CIS Engineering Conference and 2014 & 2016 Northeast Bioengineering conference.

**[This talk is counted as one-hour Indiana PDH and is free to attend.](#)**